

CLAIMS

What is claimed is:

1. A medical filter, comprising
a chamber, having
5 an interior,
a patient connection, in open fluid communication with said interior and
adapted for connection to a dialysis solution flow fixture carried by a
dialysis patient,
a transport connection, in open fluid communication with said interior and
10 adapted for connection to external dialysis solution containment
apparatus;
support structure, mounted within said interior, structured as a thin, perforated member,
having a relatively very large support surface;
hydrophilic filter medium mounted atop said support surface, having a pore size
15 capable of separating particulate materials, including bacteria, from fresh
dialysis solution;
first channel structure within said chamber defining a first flow path from said patient
connection across the surface of said filter medium to said transport connection;
second channel structure within said chamber defining a second flow path from said
20 transport connection through said filter medium and said perforated support
structure to said patient connection; and
flow control mechanism mounted within said chamber and operable to direct fluid from
said patient connection through said first flow channel and to direct fluid from
said transport connection through said second flow channel.
25
2. A medical filter according to Claim 1, wherein said second channel
structure includes a portion in communication with an air vent structure constructed and
arranged to release air from solution flowing through said interior while retaining said
solution within said interior.

3. A medical filter according to Claim 2, wherein said air vent structure includes a hydrophobic membrane positioned in the travel path of air through said vent structure.

5 4. A medical filter according to Claim 1, wherein
said filter support comprises an inner conduit, with an open interior defined by a first
wall, having a first end, a second end and a perforated section between said first
and second ends;
said first flow channel is structured to accommodate flow through said inner conduit;
10 said flow control mechanism comprises a check valve positioned at said second end,
structured and arranged to permit flow from said inner conduit through said
transport connection;
said inner conduit is positioned with an outer housing structured and arranged to define
second flow channel exterior of said perforated section;
15 said filter medium is positioned adjacent said perforated section such that fluid flow
from said fluid passageway to said open interior must pass through said
medium; and
said flow control mechanism further comprises valve means at said first end, structured
and arranged to permit fluid flow from said second flow channel, through said
20 perforated section, through said open interior and out said patient connection

5. A medical filter according to Claim 4, wherein said second channel
structure includes a portion in communication with an air vent structure constructed and
arranged to release air from solution flowing through said interior while retaining said
25 solution within said interior.

6. A medical filter according to Claim 5, wherein said air vent structure
includes a hydrophobic membrane positioned in the travel path of air through said vent
structure.

7. A medical filter according to Claim 1, wherein said filter medium comprises thin sheet material configured to cover the perforations of said perforated support structure.

5 8. A medical filter according to Claim 7, wherein said filter medium comprises a micro porous membrane.

9. A medical filter according to Claim 8, wherein said membrane has a pore size of approximately 0.2 μm .

10 10. A medical filter according to Claim 8, wherein said membrane is constructed of polyethersulfone.

11. A medical filter according to Claim 10, wherein said membrane has a
15 pore size of approximately 0.2 μm .

12. A medical filter according to Claim 1, wherein
said chamber has an interior defined by a bottom portion and a cover portion,
said support structure mounted within said interior is formed from spaced, perforated
20 top and bottom panel members, joined by perforated edge members to define a
space constituting an interior flow path between said panel members;
said first channel structure within said chamber includes first and second segments
structured and arranged so that liquid from said patient connection is directed by
said first segment, through said perforated edge members and across said
25 interior flow path to said second segment; and
said second channel structure within said chamber is structured and arranged to direct
liquid from said transport connection, around the exterior of said support
structure, through said filter medium into said space and through said perforated
edge members to said patient connection; and
30 said flow control mechanism mounted within said chamber is structured and arranged
to permit liquid flow from said second segment to said interior.

13. A medical filter according to Claim 12, wherein said bottom portion is a substantially rectilinear box and said support structure is oriented to hold sheets of filter medium approximately parallel the direction of flow of liquid traveling from said patient connection towards said transport connection.
14. A medical filter according to Claim 12, wherein said flow control mechanism is positioned in fluid flow communication with said second segment of said first channel structure, and is arranged to direct liquid from said second segment to the exterior of said support structure.
15. A medical filter according to Claim 12, including a plurality of said support structures mounted in spaced parallel relationship within said chamber.
16. A medical filter according to Claim 15, wherein said bottom portion is a substantially rectilinear box and said support structures are each oriented to hold sheets of filter medium approximately parallel the direction of flow of liquid traveling from said patient connection towards said transport connection.
17. A medical filter according to Claim 15, wherein said flow control mechanism is positioned in fluid flow communication with said second segment of said first channel structure, and is arranged to direct liquid from said second segment to flow parallel, between and across the exteriors of said support structures.
18. A medical filter according to Claim 17, wherein said second channel structure includes a portion in communication with an air vent structure constructed and arranged to release air from solution flowing through said interior while retaining said solution within said interior.
19. A medical filter according to Claim 18, wherein said air vent structure includes a hydrophobic membrane positioned in the travel path of air through said vent structure.

20. A medical filter, comprising
an inner conduit, with an open interior defined by a first wall, having a first end, a
second end and a perforated section between said first and second ends;
a flow channel at said first end, structured to accommodate flow into or out of said
5 inner conduit;
a check valve at said second end, structured and arranged to permit flow from said inner
conduit;
an enclosure for said inner conduit, structured and arranged to define a fluid
passageway exterior said perforated section;
10 a filter medium positioned adjacent said perforated section such that fluid flow from
said fluid passageway to said open interior must pass through said medium, said
medium being hydrophillic and capable of blocking bacterial-sized particles;
and
valve means at said first end, structured and arranged to permit fluid flow from said
15 open interior but to direct fluid flowing in the opposite direction into said fluid
passageway.
A
21. A medical filter, comprising
a container with an interior volume in open fluid communication with a patient
20 connection element and a transport connection element;
filter support structure mounted within said interior volume and including a plurality of
filter elements arranged in approximately parallel stacked arrangement, whereby
to define a plurality of approximately parallel flow paths straddling said filter
elements, each said filter element including
25 first and second panel members, each having an exterior surface and an interior
surface with apertures extending between said exterior and interior
surfaces,
first and second edge members connecting said panel members at the respective
interior surfaces of said panel members, whereby to enclose an interior
30 fluid flow zone within said filter element, said edge members having
exterior and interior surfaces and carrying ports arranged to permit liquid

- to pass through said first edge member, through said flow zone between opposed said edge members and out said second edge member, hydrophilic filter medium mounted to the exterior surfaces of said first and second panel members to cover said perforations; and
- 5 flow control structure within said interior volume constructed and arranged to: cause liquid introduced through said patient connection structure to flow through said first edge member, through said zone, out said second edge member, and then across said exterior surfaces of said panel members to said transport connection element; and
- 10 cause liquid introduced through said transport connection member to flow into said interior volume to surround said filter elements, through said filter medium into said interior zone and out said ports in said first edge member to said patient connection structure.
- 15 22. A medical filter according to Claim 21, wherein said second channel structure includes a portion in communication with an air vent structure constructed and arranged to release air from solution flowing through said interior while retaining said solution within said interior.
- 20 23. A medical filter according to Claim 22, wherein said air vent structure includes a hydrophobic membrane positioned in the travel path of air through said vent structure.
24. A medical filter according to Claim 21, wherein said filter medium
- 25 comprises thin sheet material configured to cover the perforations of said perforated support structure.
25. A medical filter according to Claim 24, wherein said filter medium
- Q comprises a micro porous membrane.
- 30 26. A medical filter according to Claim 25, wherein said membrane has a pore size of approximately 0.2 μm .

27. A medical filter according to Claim 25, wherein said membrane is constructed of polyethersulfone.

28. A medical filter according to Claim 27, wherein said membrane has a
5 pore size of approximately 0.2 μm .